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PATHOLOGICAL BULLSEYE DISPLAY TO QUANTITATE THE RELATIVE MASS OF THE LEFT VENTRICLE THAT IS ISCHEMIC: COMPARISON OF TOMOGRAPHIC HEXAKIS-METHOXYISOBUTYRL ISONITRILE vs THALLIUM-201 IN DOGS DURING STRESS-INDUCED ISCHEMIA.

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Experimental studies need a 2 dimensional functional display to summarize 3 dimensional pathological slice data for the region of the LV that is underperfused (UR). Thus, we developed the "pathological Bullseye" (PATH-BULL) to compare with tomographic (SPECT) BULL in dogs. Anatomic information on each PATH section generated a polar plot analogous to a SPECT BULL display and incorporating the same distortions as SPECT BULL. Blacked out areas within the PATH-BULL represent UR identified by staining. Application to 11 dogs undergoing adenosine vasodilation during partial coronary stenosis with SPECT methoxyisobutyrl isonitrile (RP-30) imaging revealed that SPECT RP-30 defects unexpectedly underestimated the size of the UR compared to Tl-201 or PATH. Expressed as a fraction of the UR/LV measured by PATH-BULL, the SPECT RP-30 was only 0.33 ± 0.12 while the SPECT Tl-201 was twofold higher, 0.64 ± 0.12 ($p < 0.05$) in the same dog. In contrast, 2 dogs with severe underperfusion due to total occlusion during stress showed UR/LV ratios on RP-30 (0.84 ± 0.18) that were quite similar to Tl-201 (0.91 ± 0.20). In conclusion, the underperfused and/or MI regions of the LV can be quantitated by the PATH-BULL polar display. The PATH-BULL is uniquely suited to compare PATH vs. SPECT, e.g., SPECT RP-30 underestimated UR/LV on Tl-201 or PATH. Dogs with severe underperfusion due to total occlusion showed agreement between RP-30 and Tl-201 which may explain why clinical studies after MI show RP-30 to be as good as Tl-201.

COMPARISON OF THE MYOCARDIAL RETENTION OF TECHNETIUM-99M-TEBOROXIME AND THALLIUM-201

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Tc-99m-teboroxime (SQ) is a new neutral lipophilic myocardial perfusion agent which is highly extracted by the myocardium. However, the relationship between tracer retention and blood flow has not been well defined. To investigate this, we compared the myocardial retention of SQ to thallium-201 (TL) in an open chested dog model using an IV dipyridamole infusion (0.3-0.56 mg/kg over 4 min) and LAD occlusion to induce a wide range of flows. Radiolabeled microspheres, TL, and SQ were injected simultaneously into the left atrium. Two minutes later the dogs were sacrificed. The myocardial retention of TL and SQ was expressed in arbitrary units, after being normalized for the arterial input function, which was determined from the integral of the tracer activity in plasma. In a total of 172 myocardial segments, retention of each tracer was compared to blood flow as determined by microspheres (flow range 3-750ml/100g). For both SQ and TL a line of best fit was established for the relationship of retention versus flow as shown below (* no significant difference versus TL):

Tracer	Equation	Correlation
SQ*	$y = 0.008 + 0.624x - 0.039x^2$	$R^2=0.96$
TL	$y = 0.027 + 0.630x - 0.045x^2$	$R^2=0.93$

Tissue retentions of both tracers over a wide flow range, are best fitted by non-linear functions with similar parameters. At high flow states both tracers underestimate true blood flow. Thus, SQ exhibits similar uptake characteristics to TL, in this canine model. With the known technical advantages of Tc-99m over Tl-201, Tc-99m-teboroxime represents a promising new perfusion tracer.

SEVERITY OF Tc-99m-SESTAMIBI PERFUSION DEFECT DURING ACUTE MYOCARDIAL INFARCTION IS PREDICTIVE OF MYOCARDIAL SALVAGE

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Previous studies from this laboratory have shown a wide variability in myocardial salvage measured by the change in perfusion defect size using Tc-99m-Sestamibi (RP30A). The purpose of this study was to determine if acute perfusion defect severity predicts salvage following reperfusion. 29 pts with anterior myocardial infarction (MI) who received acute (4.1 ± 2.9 hours, range: 0.5-13 hours [TIME]) reperfusion therapy (coronary angioplasty 17 pts, thrombolysis: 12 pts) were injected with RP30A at the time of presentation (Acute) and at discharge (Final). Tomographic imaging was performed 1-6 hours later. Defect size (# pixels <60% maximum counts) was quantitated as previously reported and expressed as a percentage of the LV (%LV). Defect severity was estimated in 3 ways: 1) average severity (Sev Index)=area of count profile <60% maximum counts/%LV (.21 ± .11), 2) Nadir=lowest ratio of minimum counts/ maximum counts of the 5 slices (.37 ± .10), 3) minimum pixel (MIN)=lowest pixel value in the 5 slices (35 ± 25 pixels). All pts had documented patency by angiography of the infarct artery following reperfusion. Salvage index was determined by (acute %LV-final %LV)/acute %LV.

Acute %LV	Final %LV	Salvage Index
49 ± 13%	24 ± 21%	.56 ± .35 (range: 0-1.0)

Correlation of salvage index with severity and TIME:

Sev Index	Nadir	MIN	TIME
r=-.53,p<.005	r=-.55,p<.005	r=-.49,p<.01	r=-.21,p=NS

Conclusion: 1) In pts with anterior MI, salvage index correlates with acute perfusion severity but not with time to treatment, 2) Acute perfusion defect severity may reflect the presence or absence of collateral flow.

COMPARISON OF Tc-99m METHOXY ISOBUTYL ISONITRILE ONE-DAY MYOCARDIAL IMAGING PROTOCOLS

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Currently there are 2 one-day Tc-99m methoxy isobutyl isonitrile (MIBI) imaging protocols: rest/exercise (P-1) and exercise/rest (P-2). The second study in each protocol involves the use of a higher dose. This study compared the image contrast in 11 pts with coronary artery disease who had perfusion defects in both protocols. Count densities from regions of interest in the abnormal (A) and normal (N) zones, and A/N count ratios (R) were derived from the short-axis tomograms of A/N. (Table)

	Rest			Exercise		
	N	A	R	N	A	R
P-1	120± 41	97±28	0.85±0.24	443±118	274±84	0.63±0.15
P-2	386±109	291±89	0.76±0.16	183± 64	126±51	0.71±0.18

As predicted, the second study in each protocol had higher counts in both N and A zones. There was no significant difference in R at rest and exercise in both protocols. However, the change in R from exercise to rest was significantly higher in P-1 than P-2 (22% vs 5%, p = 0.05).

Thus, both one-day MIBI protocols are comparable in image contrast but the reversibility of the perfusion defect is better appreciated with the first protocol (rest followed by exercise).